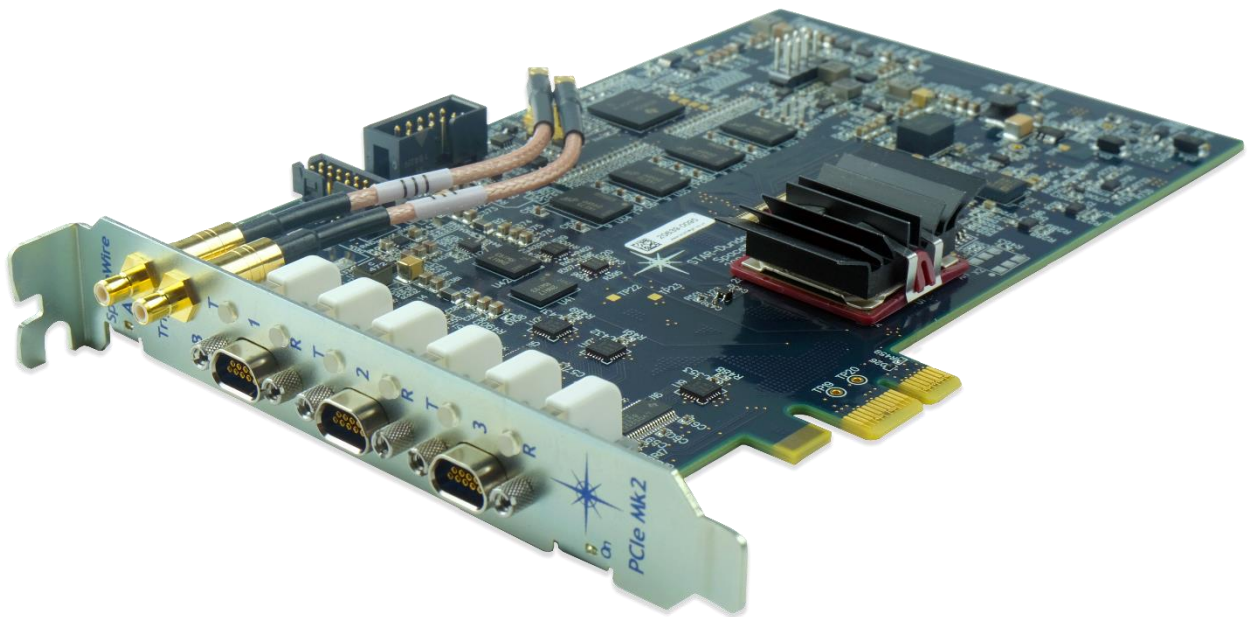


SpaceWire PCIe Mk2



SpaceWire PCIe Mk2 Board

Introduction

The SpaceWire PCIe Mk2 provides three SpaceWire interfaces with host software support for low latency transmission of SpaceWire packets directly to and from a host PC. The SpaceWire PCIe Mk2 board is a replacement for the widely used SpaceWire PCIe (Mk1) board. Backwards compatible with the SpaceWire PCIe Mk1 board, the Mk2 adds extensive fault protection to meet most FMEA requirements. The new board also includes two external triggers not present on the Mk1, to enable synchronisation of packet transmission with external events and signalling of packet reception, and other events, to external equipment. To facilitate fault protection the SpaceWire PCIe Mk2 is powered from both +3.3V and +12V, compared to the Mk1, which is powered by +3.3V only. The power for both +3.3V and +12V supplies is taken from the PCIe slot that the board is plugged into.

The SpaceWire PCIe Mk2 is suitable for all stages of SpaceWire equipment development: initial SpaceWire evaluation, instrument simulation, control system simulation, unit testing, and spacecraft equipment integration support.

Key Features

The SpaceWire PCIe Mk2 has the following principal characteristics:

Three SpaceWire Ports: Three SpaceWire ports each operating at up to 400 Mbit/s. There are two independent, fully configurable, transmit clock generators; one for port 1 and the other for ports 2 and 3. Ports 2 and 3 therefore operate at the same transmit link speed. The receive speed automatically matches the speed of the incoming data. Each port is compliant to the ECSS SpaceWire standard. The connector used is the female 9-pin micro-D connector, as required by the SpaceWire standard.

Backwards Compatible: The SpaceWire PCIe Mk2 is backwards compatible with the SpaceWire PCIe (Mk1) in terms of its functionality and the software interface. This means there is minimum effort required to upgrade to the Mk2. However, the Mk2 uses +3.3V and +12V power from the PCIe bus rather than +3.3V only. Both supplies are provided by a PCIe compliant connector.

High-Speed: The SpaceWire PCIe Mk2 is capable of transferring data at rates greater than 300 Mbit/s to and from host PC memory over all three ports simultaneously.

PCIe Compatible: The PCIe interface is a Gen-3, x1 lane. It is compatible with Gen-1, Gen-2, Gen-3 and Gen-4 PCIe slots of x1, x4, x8 and x16 widths. This provides the data rate required to support the three SpaceWire ports all sending and receiving data at the same time.

Two External Trigger Interfaces: Two external SMB trigger interfaces are provided, which can be configured as input or output triggers. Each trigger is compatible with 3.3V logic, i.e. 3.3V LVCMOS or 3.3V LVTTTL. The triggers are supported by the STAR-System Triggering API and can be used for device synchronisation, triggering of SpaceWire packets and errors, or event signalling between cards or external equipment.

Error Injection: Parity errors, escape errors and credit errors can all be injected on demand or in sequence with transmitted packets. Transmitted packets can also be terminated with an EEP.

Packet Timestamping: The SpaceWire PCIe Mk2 adds support for the STAR-System timestamping functionality. Start and end of packet timestamps can be recorded for each received packet at sub microsecond resolution. Elapsed time can be synchronised with a PPS input on one of the SMB triggers, or by a hardware timer.

FMEA Compliant: The SpaceWire PCIe Mk2 incorporates extensive fault protection to meet most FMEA compliance requirements. Protection covers the input power voltages from the host PC, overvoltage of any of the point of load converters on the board, the output voltage on the SpaceWire ports, and the trigger output voltage. The SpaceWire ports are cold-sparing, so that the SpaceWire PCIe Mk2 board may be powered down, without adversely affecting any system it is connected to by a SpaceWire link. The PCIe Mk2 SpaceWire LVDS transmitters can be tri-stated.

STAR-System Software: The SpaceWire PCIe Mk2 is supported by STAR-Dundee's STAR-System software. Example command line applications are provided with source code to demonstrate common tasks, and to test a device's throughput and latency. GUI applications are also provided to support the configuration of devices, the transmission and reception of packets and time-codes, and to inject errors.

Extensive APIs: The SpaceWire PCIe Mk2 is provided with C, C++ and Python APIs to control the SpaceWire interfaces from custom software. This can be used to integrate the SpaceWire PCIe Mk2 functionality into existing software systems and to write automated tests. Developed after many years supporting users of SpaceWire interface and router products, the STAR-System APIs provide a comprehensive range of functions for configuring, controlling, monitoring and transferring data.

First class support: A year's support and maintenance is included. This support is provided by the team that developed the SpaceWire PCIe Mk2 so that we can respond quickly with answers to your questions, give assistance with application development, and quickly resolve any issues.

Field upgradability: The SpaceWire PCIe Mk2 supports field upgradeability of the board functionality. Upgrades can be downloaded from the STAR-Dundee website and installed quickly and efficiently.

Specifications

Part Number	164
Size	Standard PCIe x1 (half length) board approximately 167mm long (excluding front panel bracket).
Power	<ul style="list-style-type: none"> +3.3V DC and +12V DC, supplied via PCIe connector. 10 Watt slot compatible, supported by all PCIe slots.
SpW Ports	<ul style="list-style-type: none"> Compliant to ECSS-E50-12A, ECSS-E-ST-50-12C and ECSS-E-ST-50-12C Rev.1. Number of SpaceWire ports: 3. Connectors: 9-pin micro-miniature D-type. Signalling: LVDS. LVDS outputs can be tri-stated. Maximum link speed: 400 Mbit/s. Status indicators: one RGB LED for each direction of a SpaceWire port which indicates the link status.
Trigger Ports	Two external 3.3V LVCMOS SMB trigger ports which can be configured as input or output triggers.
Operating Temperature	<ul style="list-style-type: none"> 0 - 25°C free air. 0 - 30°C airflow 25 LFM (0.13 m/s). 0 - 35°C airflow 50 LFM (0.25 m/s). 0 - 40°C airflow 80 LFM (0.41 m/s).
Fault Protection	<ul style="list-style-type: none"> Protected against faults on the PCIe power supplies. Protected against faults on the PCIe Mk2 board. In the event of a fault, does not produce an adverse voltage on the SpaceWire ports. When the PCIe board is powered down, the SpaceWire LVDS input current is between -20µA and +20µA. Absolute maximum external voltage range that can be applied to the SpaceWire LVDS inputs and outputs is between -0.5V and 4.0V.
EMC	The SpaceWire PCIe Mk2 board is sold as a component for inclusion in a computer unit. EMC certification is the responsibility of the user.
Software	<ul style="list-style-type: none"> Provided with STAR-System software. Application software included. Source code examples provided.
APIs	<ul style="list-style-type: none"> C, C++, Python. LabVIEW API sold separately. See website for current list of supported languages.
Supported Platforms	<ul style="list-style-type: none"> Windows (Windows 11 and 10). Linux (6.x, 5.x, 4.x and 3.x kernels, i386, x86-64 and ARM targets – other targets on request). QNX, RTEMS and VxWorks support available separately. See website for current list of supported platforms.

All information provided is believed to be accurate at time of publication. Please contact STAR-Dundee for the most recent details. © 2023 STAR-Dundee Ltd.



STAR-Dundee Ltd.
 STAR House
 166 Nethergate
 Dundee
 DD1 4EE
 Scotland, UK

Tel: +44 1382 201755
 Fax: +44 1382 388838
 E-mail: enquiries@star-dundee.com
 Web: www.star-dundee.com
 Twitter: @STAR_Dundee
 LinkedIn: STAR-Dundee